

University Chronicle

VOL. III

NOVEMBER, 1900

No. 5

THE PLACE OF PHILOLOGY.*

By BENJ. IDE WHEELER.

In the steady development and differentiation of the intellectual activities, especially during the century just closing, the peculiar discipline in whose name we are here to-day assembled has finally taken a shape and assumed an individuality which assert for it a place and area of its own, and establish some tentative boundary lines between it and its nearest neighbors, philosophy and history. The process of differentiation has been attended by one of selective coöperation, and auxiliaries like archaeology and scientific linguistics have tended to seek their place under the hegemony of philology.

The guiding power in these reciprocal processes of differentiation and of selective coöperation has not been derived exclusively or even principally from a theoretical determination of the proper scope and purpose of the related disciplines. The various definitions of philology which have had vogue, and particularly that of Boeckh, may have served some purpose in giving here and there direction to effort and determining division of tasks, but of vastly greater weight have been the facts, the actual facts composed of what has actually engaged the interest of individual philologists and of philologists as a class, under

*The President's address at the first annual meeting of the Philological Association of the Pacific Coast, December 30, 1899.

the necessities of their teaching and through the bent of their minds as conditioned by the materials and methods of their study. A scholar's interests will in the long run conform to his studies, and his studies are prone to take the direction of what he teaches in the schools and of what he was taught in the schools. An *a priori* determination of what philology ought to be is likely to prove as vain as Gottfried Hermann's conclusion reached by eminently convincing philosophic reasoning and enunciated as a final dictum in his famous *De emendanda ratione Graecae grammaticae* of the year 1801, to the effect that the possible number of noun cases is by nature limited to the Latin six: "quandoquidem nec plures esse quam sex casus possunt, nec pauciores esse debent." A few years later the emerging science of comparative grammar mocked his metaphysics with the demonstration that the parent language of Latin and Greek possessed two cases, the instrumental and the locative, in addition to the six.

It has occurred to me that instead of attempting to locate philology on the barren ocean by aid of the stars we might traverse the land and find men at their work, so that we might perchance be able to report, not so much where philology ought to be and what it ought to do, as where philology is and what it is doing. If this attempt should assume the appearance of taking account of stock, it still could not be urged that the time is inappropriate, seeing that we stand at the portals of the last year of the century inspired by Wolff and Boeckh; nor again could it be urged that the *place* is inappropriate, seeing that we are assembled at the spot where Mediterranean civilization halts at its farthest Hercules' Pillars before taking the last leap into lands it has yet to conquer.

If we turn now to examine the work which is actually engaging the attention of scholars whose training and whose activity are called philological, we shall find a large proportion of that work applied in teaching the elements of foreign literary tongues or in studying with a view to giving

these elements a clear and appreciable isolation. The mechanism commonly employed for teaching a language consists of the artificial classifications of descriptive grammar. The paradigms and other classifications of forms struggle toward arraying like form under like idea in a system which can at the best be highly incomplete, and which, in the presumption that like is like expressed, rests upon ultimate deception, and is therefore merely artificial. The rules of syntax are likewise an artificial grouping of apparently like phenomena, never complete, generally clothed in the guise of a pseudo-logic, and, in the presumption that different words representing different ideas can be fully united in a category such as subjunctive, dative, present, future, permanently false to the psychology of speech. The present *to hit* is a very different thing from that which we call present in the case of *to pound*. *Ye* is the plural of *thou*, but *we* is not the plural of *I*. Under the name subjunctive are assembled the most diverse ideas, their diversity being largely dependent upon the denotation of the word itself.

And yet, with all that may be said against descriptive grammar, it furnishes a tentative method of approaching and grasping the first phenomena of a language which as a practical device cannot be spared,—at least for those who have passed beyond the purely imitative stage of childhood. Adults and generally also youths above the age of twelve to fifteen require some pseudo-rational classification of the facts of language in order to appropriate them with the greatest readiness and certainty. The "natural method" involves for adults, when not combined with some teaching of classifications, a great waste of strength and time. Languages which are acquired in childhood by simple hearing and imitation, as additional to the mother tongue, do not appear to involve high educative value. The results incidental to a command of languages so acquired are of course not to be confused with the educative effects of the effort of acquiring. No better evidence is needed concerning the low

educative value in the purely imitative acquisition of stranger tongues than such as is afforded by observation of communities situated at or near linguistic frontiers as in Austria or Switzerland, where a child learns naturally and without effort to speak two or three languages. The peoples of these communities show no indication of intellectual superiority. The first acquisition of language involves unmistakably for the child a supreme educative effort. The assorting and filling of the moulds of thought which accompany this acquisition constitute the educative value. The second childhood language, however, generally utilizes on the whole the same moulds; each phrase of one language comes to have its counterpart phrase in the other. The intellectual nerve is not quickened; the intellectual grasp is not toughened.

The chief educational mission of the teacher of the elements of language, if we overlook the results incident to the possession of a language as a tool, is to force the mind of the pupil into providing the new psychic moulds for the new language material. Here arises the question of translation and its educational value. If translation undertakes merely the bald transfer of words and phrases, it is a purely mechanical proceeding like the pasting of stamps into a postal album, and carries with it little educational value beyond quickening of the memory and the attention. It is likely to involve too a debasement of one's standards of expression in the mother speech. Good English translation is one of the most difficult of exercises, and consists of two distinct disciplines,—first, the complete, sympathetic grasp of the thought conveyed in the sentence to be translated; second, a serious effort,—and this belongs with English composition,—to express the thought, which has now become the translator's possession, with all its tones and colorings, in good English. Unless the second part can be done carefully, the teacher must resist all temptation to apply mere recitation tests and abide by the former, though he will do this at great loss, for a very large part of the "converting

power" of language study resides in this much despised exercise of translation. Acquaintance with Greek thought, for instance, though an important educative aim of Greek study, cannot be counted the goal of Greek study *viewed as a linguistic discipline*. Constraining the English language moulds to receive the thought conduces toward the suppleness of thought essential to sympathy, which is the true goal. Thought that does not habitually yield itself to formulation in the linguistic moulds is apt to be, for the purposes of use in the organized society of man, vague and profitless.

In continuing our examination of the work which occupies philologists, we should find a considerable body, particularly in this country and perhaps more among Latinists than among the representatives of any other branch, devoted to the investigation of the higher problems of syntax. The impulse to this form of work has arisen less from the desire to penetrate into the thought expressed by the language than from the desire to formulate into quotable types the usage of a language whose thought has been already keenly and sympathetically felt. The task is to identify the prevailing types of word-combination existing in the organization of the sentence. When the work extends to the observation of these types as they extend or decline, and to the determination of which is older, which younger, and possibly to investigation of the causes of extension or decline, it is called historical syntax. Comparative syntax is its occasional auxiliary. These prevailing types which it is the object of syntax to determine cannot, however, be held to represent types or moulds of folk-psychology, as it was once the dream of Lazarus and Steinthal to demonstrate, except so far as such psychology was itself the product of the language and the peculiar combinations in its mechanism. The best which syntax therefore can hope to attain is the identification of certain general ruts or grooves which the combinations tended to follow, but with the certain limitation that like forms of

words of different meaning are not committed to like grooves. The effort expended in this identification tends to induce a careful observation and fine discrimination and leads toward the determination and summarizing of those conventional types of word-combination, which, however they may have been created, condition, restrain, and mould the popular thought. Therein lies the advantage of syntax as a discipline on the one hand, as a science on the other. If conducted, however, on the assumption, implied or expressed, that logical principles accessible through metaphysical reasoning are involved in the formation of the types, nothing but mischief can be wrought for teacher, text, and taught.

The study of historical grammar in the form of comparative morphology and phonology has yielded tribute on the one hand to the general science of language, on the other to philology. As tributary to philology it serves the purpose of showing how the outward form of language is historically conditioned. By distinguishing the old from the new and establishing a chronology of form-development, it furnishes syntax with its only sure foundations, and provides one of the only two possible bases for a real classification of language-phenomena. The other possible basis is not that of descriptive grammar, which is utterly artificial, and neither scientific nor popular, but is that of the folk-consciousness, of the language as it rests untouched by reflection in the mind of the folk. Classification upon this latter basis, all-important as I believe it will yet prove to be, has not yet been attempted, owing to lack of competent observation of the facts. Psychology is still too young.

The earlier enthusiasms of historical grammar, nurtured upon the hope which came to its baldest expression in the work of Schleicher, that the science of language might follow the ways of the natural sciences, have been of late years, it is true, somewhat chilled, as deeper penetration into the true nature of speech has revealed that the science takes its place perforce with the historico-social sciences. The results

of the study may not prove to have either the range or the certainty which was at first expected of them, notably in their applications to the fields of ethnology and comparative religion, but it is unmistakable that the science is rapidly finding its true place, and that that true place leaves it in closer sympathy with the established methods of philology. They both in the last analysis deal with uniformities and laws which represent social compromises due to the surrender of individuality in the intercourse of masses of men brought together in historical life.

Historical grammar as dealing both with the moulds of form and with the combination-types of syntax will prove to be inseparable from philology and indispensable to a philological equipment. It is particularly essential that the teachers of the elements of language should be thoroughly trained both in the principles governing the life and growth of language in general, and in the history of the language they teach in particular. It is essential in order that the artificial classifications which for pedagogical purposes they are compelled to employ may never assume the position of real things either with teacher or learner; that is to say, it is particularly essential *for the very reason* that historical grammar and the so-called comparative philology *cannot* be taught to beginners. The arbitrary introduction of tidbits of historical grammar and of syntactical lore into an exercise of interpretation when they do not directly serve the purposes of interpretation is simply grotesque pedantry. The exaggerated attention paid to syntax at present in American class-rooms of Greek and Latin constitutes the severest menace to the usefulness and therefore to the continuance of classical study which now exists.

The seminaries and to an undue extent also the lecture-rooms of Germany are at present dominated by the exercise in textual criticism which constitutes as much of a menace there as syntax does here. Both are, however, a menace only in their disproportion. Both are the handmaidens of hermeneutics. Both give skill and certainty of grasp in

interpretation. Conscientious interpretation will insist first of all upon knowing what is written. Among the divergent traditions of the text it will seek for some reasonable ground of choice. The *δύσθωσις* (*recensio*) will precede every attempt at independent interpretation. As sympathy with a text and its author's thought advance, the temptation to occasional exercise of the divinatory criticism will arise. Such criticism indeed, though the chances are always heavily against its success, has its place as part and parcel of the *interpretation*, but is never an end to itself. The practice of seminaries in framing conjectures has undoubtedly served much purpose in sharpening wits and enforcing reflection, but it has also served to encumber would-be scholarship with vast accumulations of hopeless lumber. An exercise begun with the purpose of aiding interpretation has to a considerable extent become an end to itself and led philology out upon the arid and trackless deserts of pedantry.

In the exercise of the various tasks to which we have thus far alluded it may be questioned whether philology has not turned its look too far away from what we ordinarily understand by literary study. Philology concerns itself primarily with literary documents. Its professed traditional aim is the interpretation of literary documents or of a life betrayed most fully in such monuments. If it fails of reaching this goal, it will be held to have failed entirely,—at least in the court of common judgment. If it spends all its time and all its strength in sharpening and whetting its tools for that which is to be its ultimate work, it will be looked upon as either a visionary or a deceiver, a fool or a fraud.

Literary study may be either the study of a fine art whose material is language,—in which case it is a branch of aesthetics,—or it may be a study of the ideas and forms of thought involved, in which case it can hardly escape becoming a branch of history through its dependence upon historical modes for an understanding of these forms. The

almost complete differentiation of historical studies from philological, which the present century seems to have brought about, has as a matter of fact robbed philology of its historical power. The training and tastes of the men who have actually represented the philological activities have not led them into sympathy with the historical point of view. They have left this under the division of labor too exclusively to the professional historians. Here we have then an unmistakable and most emphatic illustration of the view that the scope of philology is determined not by theoretical definitions so much as by the actual tastes and occupation of the men actually engaged in its pursuit.

The philologist in his painful concentration upon the details of fragments and his absorption in the task of restoring a condition which belongs to a single time and status has undoubtedly lost something of that power of perspective which a consideration of the historical meaning in reference to conditions related by succession in time is alone able to impart. While therefore it is evident that he cannot afford to yield entirely the historical point of view, it must however be remembered that he is primarily concerned with restoring a condition which exists in a single plane rather than in establishing a line of descent. The historian will utilize his results. From the philologist the historian will learn atmosphere. From the historian the philologist will learn perspective.

Absorption in the task of teaching the elements of language and mastering the various branches of linguistic study has furthermore diverted the average philologist from literary aesthetics. In the philological class-rooms of Germany and America pure literary study has been reduced dangerously near to a minimum. The influence of the methods employed during the past century by the natural sciences has been undoubtedly in a measure responsible. On every hand one marks the effort to establish aesthetic criteria by measuring and counting and classifying. A large japanned tin box full of cards provided by the

cunning of the Library Bureau will not however yield with unerring and mechanical certainty its expected semestral output of literary taste.

We have been speaking of the way in which the actual facts of the experience and interests of those who are called philologists have served to determine the place and definition of philology. An example of this has been afforded in the last two decades by the new animation imparted to classical study through men who have studied at Rome and Athens. Most of the students who have pursued archaeological studies in connection with the American schools at Rome and Athens have on their return to the practical work of teaching become perforce philologists rather than archaeologists. There has not been a sufficiently large demand for archaeological specialists to absorb their work for this distinctive field. Philology has been thereby the gainer. Contact with the habitat and the material remains of ancient life has quickened in these men a sensitiveness for this life as real. They have become interpreters in a more direct and definite way. They have brought new materials to bear in the task of reconstructing the thought and form of ancient life out of its fragmentary remains. The very fact that these men have been absorbed into the philological mass through the accident of conditions that temporarily at least forbade the fuller organization of archaeology as a clearly differentiated discipline has served to widen and enrich the practice and consequently the conception of philology. If we admit that philology has indeed no boundaries established in the inherent nature of things, then is it true that the fact has actually enriched and widened the very definition of the term.

Without proceeding further in our illustrative survey of the field actually occupied at present by the activity of the representatives of the discipline, let us turn to a precision and summary of its significance based upon what we have observed and what we in general know as to that field and its work.

The work is in the first place characterized by the necessity under which it labors of restoring and reconstructing a whole out of fragmentary materials. The literatures as rescued monuments of a past are in themselves but fragments and parts. Out of the entirety of Greek literature for example has been rescued only a few samples, a few such as the needs in the main of the rhetorico-philosophical schools of antiquity selected as worthy of duplication and consequently of preservation. Chance has had its say to some extent, but on the whole the texts read in the schools are those that have been thus preserved,—a little school library of standard epics, lyrics, dramatics, historians and philosophers. From these and their allusions and citations we have to restore an impression of the contents and purpose and tone of a vast literature. Even the rescued texts are battered, torn, and shop worn, and must be the continual objects of a study that guides through a schooled and chastened imagination to a realization of the original.

The language has not been preserved either in living voice or in completed thesaurus, but must with painful labor and patient collecting, sifting, classifying, be reassembled from the leaves of parchments and papyri and from fragments of stone, and find its meaning through the interpretation of texts and the searching of feeble glossaries and the collating of the chance scribblings of the scholiasts.

The restoring and reading of the inscriptions represents most sharply and concretely the work of the philologist. From three dim letters on a *stoichedon* inscription the epigraphist divines a word, and with the help of his knowledge of the formulas and by counting the spaces fills a line; so that often from the rescued edge of a stone he reads a whole, four and five times the extent of the given material.

This applies to the entire field and method and work of philology. What the architectural archaeologist does in restoring the plan and conception of an ancient building by

help of a few column drums, a few intercolumnar spaces, traces of a foundation wall, and fragments of an architrave or cornice, the philologist must do with fragments of a structure of human thought. The harmonies and measurements yielded by the column-drum and cornice-fragment are represented by the spacing of letters or the moulds of metre or the trend and continuity of the thought divined. Throughout there is demanded the most accurate knowledge of all that reconstruction has yet accomplished and a divining imagination based thereon and able to throw its cantilevers out into space. Herewith we may characterize and identify most surely the philologist's work.

He deals primarily and principally with language, the language that expresses and sets forth the life of a culture that has lapsed into the past, but which had a unity, and harmony, and measures inhering in an established and solidified scheme of conventional historical life. That which links together the exercises of advanced investigation such as the philological specialist pursues and the first efforts of translation and interpretation such as occupy the beginner in the study of language is this essentially characteristic method of divining a whole out of incomplete data. The boy who is laboriously collecting the data afforded by case and tense and word-order and with help of the known harmonies and measures yielded in the ascertained moulds of syntax, is restoring, however crudely, a meaning for the sentence, is doing the work and receiving the training which belong to all the endeavors of philology. Out of data that at the best will always prove incomplete, he is divining the vanished whole. The educative power of the exercise inheres first in the constructive effort of assembling the materials; second, in the use of the memory for aiding the assemblage; third, in the intelligent direction of the imagination toward reconstruction; fourth, in the cultivation of the power of contingent reasoning. The fourth is akin to the third, and together they constitute the all-important educative and uplifting power of language-study.

Contingent reasoning is the form of reasoning we apply almost exclusively in the practical doings of life. It is life-reasoning as distinguished from absolute or mathematical reasoning, and as such it is the form of mental reasoning most available for use, most essential to effective living, and most desirable to cultivate. As language is the most potent educator of the child, so it has always been of the race. It represents in its very texture the thought and the reason of the natural man, and is the most human thing produced by human men. Mind is thus naturally nourished during its growth by a food which is itself a natural product of mind. Life is fed by life.

The existing place of philology among the learned disciplines has been established and defined by the facts of educational practices and the demands of learned study in connection therewith quite as much as by any logically determined boundary marks.

The tradition of the schools as formulated by the Renaissance appointed its general scope. The successive differentiations whereby other disciplines like philosophy, history, archaeology have been created out of its body have narrowed its field and intensified its vision even to the encouragement of dangerously narrow concentration. The surrender of history has wrought temporarily at least some mischief, as has also the loss of control over instruction in the vernacular which prior to the development of departments such as English composition, or "English" outright, rested chiefly in the hands of the classical philologists. Those who to-day contend for the old classics as affording the true cultural course of study, in spite of the limitation to a small range of subjects, do so in assertion of the old undivided claim. They still propose to teach many of the differentiated subjects incidentally or as latent in the body of the whole. Whether they do, depends as it always has, very much upon the teacher. If the modern specialized philology is taught, however, it will not be culture that results, any more than from the teaching of other

specialized subjects. The real question at issue is not so much one of subjects as of the period for introducing the differentiated and specialized types of the great civilizing and educating subject,—human thought in the life-form.

After all delimitations have been reckoned with, and all the readjustments have been effected, there remains for philology a well-defined place and task. Language is its chief material. The life-thought of a people is its chief object of study. History, geography, art, antiquities, manners and beliefs, institutions and government,—all of these it must understand and utilize for its interpretations, but it is through language as the open window that it must look straight in upon the life and with the straight, whole look of sympathy learn to comprehend and relive it.

KING ALFRED AND HIS MILLENNARY COMMEMORATION.*

By LOUIS DYER.

Loyal republicans though we are, we Americans can still find something to suit our mind in the words used, twenty-odd years before America was discovered, by Sir John Fortescue to the young and ill-starred Edward, Prince of Wales, killed at Tewkesbury about a twelvemonth afterward. The exiled Chief-Justice, instructing this exiled Lancastrian prince, quotes Holy Writ in declaring it "the office and duty of a king to fight the battailes of his people, and also rightly to judge them." Fortescue's words are all the more sympathetic because he did not hold with King James II that "The state of Monarchie is the supremest thing on earth." In fact Sir John Fortescue's mood was the very opposite, for his account of the office and duty of a king harks back to the clamors of Israel refusing to obey the voice of Samuel and shouting: "Nay, but we will have a king over us; that we may be like all the nations; and that our king may judge us, and go out before us, and fight our battles." But still it behooves us as Americans and republicans to remember John Eliot's preface to the Christian Commonwealth, where the Indian Apostle says, in comment upon the same verse of Samuel cited by Sir John Fortescue: "When a Christian people are to choose a government,

*Address before the English Department of the University, in the Harmon Gymnasium, November 13, 1900.

should they take their patterne from the nations of the worlde? We know what an offence that would be to Christ, who intends to rule them himself by his own divine patterne and direction." Now Fortescue, little as he inclined to magnify the office of king, was far removed from 'Commonwealth' days, and his old-fashioned theory of the 'rights of man' lurks behind his declaration that "just as out of the embrion riseth a body naturall ruled by one head, even so of a multitude of people ariseth a kingdome, which is a body mysticall grounded by one man as by an head." In the 'mysticall' body 'politique' as thus conceived, the relation between king and people is explained as all the more intimate and all the more indissoluble because "the King of England cannot change the lawes at his pleasure." Pym takes this view in his arraignment of Strafford, saying: "The Laws of this Kingdom have invested the Royall Crown with power sufficient for the manifestation of his goodness, and of his greatness," and much else even more explicitly identical with Fortescue's doctrines.

The reason why the king may not change the laws at his pleasure was first given by him whom Old Chroniclers delight in styling quite unwarrantably "the first king of all the English,"—Alfred, when in the preamble to his laws, he explains that no new laws have been added in place of certain ones of his predecessors, omitted with the advice and consent of his wise men, "because I could not know whether those who came after us would approve." Here Alfred characteristically eschews the royal plural, using us, as always, for himself and his wise men. The antiquity in England of this dictum that the king cannot change the laws at his pleasure makes it tolerably clear that Sir John Fortescue had in his mind when he discussed the office and duties of a king something more than a Bible text. We must fancy that he, too, like Pym in arrainging Strafford, and most explicitly our own William Penn in defending his good right to hold a meeting in the London streets, associated the goodness and greatness of Alfred with the liberties

of Magna Charta, and the immemorial immunity of Englishmen from arbitrary rule. Indeed, without Fortescue, who certainly does not mention Alfred, the roll of those who dwelt fondly, at moments of intense political feeling, on dim records of the Old-English kings, to whom they instinctively ascribed just the perfections which the momentary crisis called for, is a long one, and includes the colonists of Ann Arundel County in Maryland. This habit of retrospection began rather ludicrously under Henry II, William the Conqueror's youngest son, in the lives of that feeblest and most incompetent of Alfred's direct descendants on the throne, Saint Edward the Confessor, which glorified in him the good old days before the Conquest with little or no regard for historical facts. The same inveterate habit declared itself in Bradshaw's stern reproof of Charles I at his trial; and Englishmen still indulge in it. As time went on Saint Edward bulked less and Alfred more in these retrospections, and of Alfred we can truly say that none of all the unhistorical and enthusiastic improvisations about him make him out greater or better than the unvarnished facts would warrant. "Even his legendary reputation," said the late Professor Freeman, "is hardly too great for his merits."

We have indeed authentic records showing that no king ever performed the two essentials of fighting the battles of his people and rightly judging them more strenuously than Alfred. Much in the long-accepted record of his reign has proved apocryphal and been called in doubt, but not his love, not his self-devotion. The chief things that tell against him are the result of his superlative excellence, and people quarrel with his memory nowadays because so many enthusiastic eulogists have, for the love of him, bid defiance to human possibilities and probabilities; so many clumsily invented anecdotes, like that of the burnt cakes, or of his expedition inside the enemy's lines disguised as a harper, have obtained currency; so many glorious institutions of which he never dreamt, such as trial by jury, the British

navy, the subdivision of England into shires, have had Alfred thrust upon them as their founder. All this now envelopes him in an atmosphere of controversy which not only is repugnant to his straightforward and uncomplicated character, but, what is worse, obscures his really glorious achievements quite as effectually as did the feeble improvisations about him which our fathers looked upon as true. That Alfred himself would have grieved bitterly at such a state of things is plain enough from words all his own and not at all warranted by the particular passage of Latin which he is translating, in the thirteenth chapter of his Old-English version of Boethius. There, as if foreknowing that his good name might some day require vindication, he says: "It is abundantly manifest that the good word and good fame of every man is better and of dearer worth than any wealth. . . . His heart's secret places it opens and breaks through the bars of his neighbor's heart, and in the way between them it is not belittled, nor can any man with sword slay it, nor with rope bind, nor does it ever perish." Again in the seventeenth chapter of the same work, he breaks away from his Latin text to make what might be considered his own plea for fair treatment at the bar of posterity when he says: "It behooves me in all truth to say that my resolve has been to live worthily and to leave to men who should come after I have lived a remembrance of me in good works."

We may then almost say that Alfred himself will rejoice with us if we can say that there are good works of his enough and to spare which are clearly known quite apart from all pettifogging controversies and debates of doubtful issue. More than Alfred's unremitting fulfillment of Fortescue's whole duty of a king, more than his steadfastness in war, more than his unwavering justice in peace is incontrovertibly known to us of Alfred. He devoted himself to study, late in life and under the most incredibly adverse conditions, with an aim so high that, to quote from Pauli, his ablest German biographer, the like of it "was entertained

by no earthly ruler before his day." Looked upon from this aspect, his high conception of the duties of kingship and the remarkable abilities which it called into play, place him by the side of Marcus Aurelius and entitle him to the Platonic designation of 'philosopher-king.' After the alarums and affrays were growing fewer, which made the first half of his reign a veritable 'Dance of Death,' Alfred devoted to study and to authorship such of his energies as could be spared from "the various and manifold worldly matters which constantly preoccupied his mind and strained his bodily powers," to quote from the Old-English preface to his Boethius. He was resolved to give his people means of self-improvement. This most unique interest of his would certainly have commanded the sympathy of Charlemagne, but Charlemagne, his grandfather's friend, lacked a certain strain of Celtic suppleness in mind which Alfred obviously possessed. Charlemagne had the will but not the abilities of Alfred in the matter of books and book-learning. Alfred's aims and achievements in literature are vouched for by no doubtful or hearsay evidence: we have his books as the result, and we know that he was the framer of the first Old-English prose. Furthermore, he has explained his motives for becoming an author in his own preface to the the most minutely wrought of all his translations from the Latin, his Old-English version of the book which "is called in Latin *Pastoralis*, and in English *Shepherd's Book*,"* that is, the Pastoral Care of Pope Gregory the Great, for whom, as the pontiff who decreed the conversion of England, Alfred's gratitude and reverence were unbounded. "The wise Gregorius," says Alfred, "was versed in many true doctrines through the wisdom of his mind, his hoard of cunning thoughts. For he gained over most of mankind to the Guardian of Heaven, best of Romans, wisest of men, most gloriously famous."

When we read Alfred's preface to this translation, he

*I have used Mr. Henry Sweet's translation, published by the Early English Text Society.

unlocks his heart, and, along with his reasons for this and other works, gives us certain especially interesting autobiographical glimpses. "It has," says he, "very often come into my mind what wise men there formerly were throughout England both of sacred and secular orders; and how happy times there were then throughout England; and how the kings who had power over the nation in those days obeyed God and his ministers; and they prospered both with war and with wisdom." Alfred speaks whereof he knows, for the kings especially alluded to are his grandfather, King Egbert of Wessex, the 'Wielder' or Overlord of all Britain, and his father, Ethelwulf of Wessex. Egbert was above all a fighting king, but his son Ethelwulf, in the nineteenth year of his reign gave the tenth part of his land "for the glory of God and his eternal salvation. And the same year," says the *Old-English Chronicle*, "he went to Rome in great state, and dwelt there twelve months." But to resume the interrupted preface, Alfred goes on about the good old times, and "how foreigners came to this land in search of wisdom and instruction, and how we should now have to get them from abroad, if we were to have them." Then we hear more of the decay of learning, and Alfred says there were very few "on this side of the Humber who could understand their rituals in English, or translate a letter from Latin into English. So few," he adds, "that I cannot remember a single one south of the Thames when I came to the throne. Thanks be to God Almighty that we have teachers among us now." Between these lines we read plainly enough that, in Alfred's day, all teachers were of the clergy, although many of the clergy were untaught. Not even all Bishops could be depended upon for learning. The incapacity of the *Old-English* for letters was so marked that Alfred's literateness is the most conspicuous among several signs indicating that he was partly Welsh. How he himself got his learning and did his work appears at the end of this preface, where he explains that he began translating from Gregory "sometimes word

by word, sometimes according to the sense," as he had learnt it from Plegmund, his archbishop, and Asser, his bishop, and his mass-priests, Grimbold and John. Furthermore, he anxiously provides for sending a copy of his translation to every minster in his realm, and that no man "take the book from the minster, as it is uncertain how long there may be such learned bishops as now, thanks be to God, there are nearly everywhere." Alfred thanks God for his learned bishops, but he himself took endless pains to secure them. Asser he lured from St. David's in Wales, and made of him his bosom-friend. His policy was to be on the lookout for learning or the promise of learning, and when he found it in any man to see that he duly qualified himself, and then to make a bishop of him. Indeed, there is a moderately authentic case, besides Asser's, to show how Alfred's policy in this regard was carried out. Although it appears that the story of Alfred's letting the cakes burn and incurring the reproof of the wife of a swineherd in the neighborhood of Athelney, is an embellished episode in the flimsy legend of Alfred reclaimed by St. Neol from sowing wild oats, there is yet something of importance lurking behind this improving fiction,—a story about a swineherd given as of common report by Florence of Worcester. This story has it that Alfred made friends, during his dark days in hiding near Athelney, with an unlettered swineherd whose turn for letters so impressed the king that he took his education in hand, and finally the swineherd, Denewulf by name, became Alfred's Bishop of Winchester. If not true, the story at least serves to enforce the truth that Alfred was always on the lookout to find possible appointees for his bishoprics, and this amounted in his day and generation to what in ours has become the endowment of research.

Reverting once more to our much interrupted preface, the golden times so feelingly described by Alfred went back, according to Alfred's view, far enough, no doubt, to include the Venerable Bede, who lived north of the Humber,

but whose pupil, the great Alcuin, went from York to enlighten the realm of Charlemagne in the days of Alfred's royal grandfather, Egbert. What is important for us to keep in mind is that between the days of Alfred's childhood and earlier youth, and the time when he came to the Wessex throne, in 871 A.D., the ghastly shipwreck of learning and holy-living, over which Alfred mourns, had overtaken England. "I saw," Alfred goes on to declare—always in the same preface to the Shepherd's Book of Gregory the Great—"I saw, before it had all been ravaged and burnt, how the churches throughout the whole of England stood filled with treasures and books." Before we turn back from the middle to the beginning of Alfred's reign to look closely upon the tragic outset of his kingly career, let us go still a little farther, hand in hand with him, into the statesmanlike preoccupations of his later years. The final remedy for all the havoc wrought in England by the heathen Danes occurred to Alfred and was put by him before his bishops,—to whom was addressed the whole preface under our continued consideration,—as follows: "It seems better to me, if ye think so, for us to translate some books which are most needful for all to know into the language which we can all understand, and for you to do, as we very easily can, if we have tranquillity enough." Mark how his 'you' becomes 'we,' and note with what convincing earnestness he strives to gain the bishops' good opinion for his plan, and yet how the fear of more pillaging and maurading Danes is always lurking behind every plan and mocking every hope. What Alfred now goes on to say is the root of the whole matter and is thus propounded by Alfred: "that all the youth now in England of free men, who are rich enough to be able to devote themselves to it, be set to learn, as long as they are not fit for any other occupation, until they are well able to read English writing, and let those be afterwards taught more in the Latin language, who are to continue learning and be promoted to a higher rank." Alfred had no illusions. He knew his

Saxons well, and did not dream of schooling for any man among them who was fit for any other occupation. His Utopia, where the privileged few, the very rich, might hope with great pains and lavish expense to learn to read English writing, may provoke a smile, but it assuredly speaks volumes for the backward state of the Old-English in his day. He does not so much as suggest that any one be taught to write, nor is this unnatural, since, like Charlemagne, he himself fell far short of being a scribe. The huge seals and the signs of the Holy cross, which are appended to Old-English documents of his day may serve as a commentary upon Alfred's omission of any plan to teach the noblemen of Wessex the vexatious art of writing.

However that may be, Alfred's programme of 'Secondary Education for England' just quoted, is all, excepting perhaps the coins struck at Oxford in Alfred's name and with his effigy, that now is left of that marvel of the days of Queen Elizabeth and King James,—Oxford University (or more especially University College, Oxford, founded by Alfred the Great in the ninth century after Christ. To be sure, we may, if so inclined, take seriously a curious passage in Asser's *Life of Alfred*, where we read that the good king of Wessex devoted annually one-eighth of his total income "to the school which he had studiously collected together, consisting of many of the nobility of his own nation." But he who believes all this must be able to tell us who was Alfred's Chancellor of the Exchequer. Moreover, he must go on with the further statement that the same Alfred devoted another eighth of his yearly income to monasteries "in all Saxony" (Saxony in the mouth of a Welshman, like Asser, means simply Wessex) and Mercia. Oxford was undoubtedly in Mercia. There is a certain amount of rather shaky evidence showing that St. Frideswide's at Oxford was founded many years before Alfred. Accordingly some part of this second eighth of Alfred's revenues might be supposed to have gone to support the school at St. Frideswide's, if the attested fact that there was a school

at that monastery two hundred years after Alfred's day could persuade us that the school existed there under Alfred when Oxford was a favorite haunt of the Danes. On the whole, this excursion into the regions of the highly improbable is not likely to yield profit, and the safer plan by far is to conclude that the whole account of Alfred's exchequer in Asser's life originated in the subtle mind of some astute ecclesiastic anxious to encourage millionaires in his own day to emulate the paragon of English kings in generous donations to the Church. Alfred founded no Oxford colleges, endowed no Oxford professorships. Nothing, in fact, remains of his whole educational plan, except the essence of it, his intense conviction that national life without national education is suicidal for man because it cuts him off from the right worship and due obedience of his Maker. Those who know modern Oxford best see most clearly how much is there patriotically sacrificed to the needs of the nation, how much is done in order to man the British Empire. If performance of this duty may go to prove foundation in Alfred's spirit, then indeed not Oxford only but also its sister university at Cambridge must have that glory. On the other hand, if we scan the whole range of English history, old and new, at home and in the colonies, the closest parallel to Alfred's educational proposals, made to his bishops under such unpromising and disheartening circumstances, will be found in the earliest move made to establish a school in the Colony of Massachusetts Bay,—in the founding of the Grammar School which so soon became Harvard College.

In turning to the dark days when England was all but wrecked by the Danes, and Alfred, after the successive deaths of all his three brothers, ascended the tottering throne of Wessex, the first cause for admiration is that the man had courage enough to think of reigning at all. The 'golden' words, addressed to her last parliament by Elizabeth, might well have fallen from Alfred on the day of his accession. "For my own part," said the aged and outworn

queen, "were it not for Conscience sake, to discharge the duty that God hath layd upon me and keep you in safety, in mine own disposition, I should be willing to resign the place I hold to any other, and glad to be freed of the Glory with the Labours." Labors enough and to spare, Alfred had already had, before he became king in 871 A.D. The political situation of the Anglo-Saxons in England, when history repeated itself, and their own invasion of three hundred and fifty years before began to be reënacted, to their dismay and at their expense, by men of their own race in 794 A.D., was practically that of Israel in the Land of Canaan, which is described in the books of Joshua and Judges. The seven kingdoms of the so-called Heptarchy, into which we used to learn that the Old-English were neatly subdivided, are almost as mythical as the seven sons of the god Woden from whom the kings of the Heptarchy are fabled severally to have descended. The use of the term king among the Old-English of those days is strictly parallel to its use in the eighth and four following chapters of Joshua. How unfixed its meaning was, even in the the mind of Alfred, himself a king, and living more than a century later than the first inroads of the Danes, he shows us in his translation of Orosius,—an historical summary by various hands which became, before Alfred had done with it, a sort of Old-English Gazetteer of Geography, History, and Antiquities. In that translation he reproduces the words 'consul,' 'dux,' 'praetor,' and 'pro consule' all by the Old-English 'cyning,' *i.e.*, king. The Saxons, Jutes, and Angles in their first homes beyond the German Ocean, and the Anglo-Saxons during the first four hundred years of their abode in England, like the Israelites in Egypt and in Canaan up to the anointing of Saul, had not yet risen to the conception of a single king ruling them as one nation. Edward the Elder, Alfred's son and successor, was indeed the first king of all England, fused into one national mass in the crucible of adversity. The invading Danes brought this to pass. Alfred's dominion was strictly speaking Wessex, the south-

western corner of England, to which he added Mercia,—a district comprising the lion's share of Midland England from Wales to the German Ocean,—where Alfred's father-in-law was a man of consequence.

Alfred was married at twenty, three years before his accession, and had hardly led his bride home to Wessex before he was summoned back to Mercia without her in order to begin his life-long struggle with maurading Danes by laying siege to the town of Nottingham, where he had just been married. Next year, in 869 A.D., the cloister at Bardeney, Croyland Monastery, Peterborough, Huntingdon, Ely, "filled with treasures and books," were looted; and East Anglia,—Norfolk, Suffolk, and Essex,—was appropriated by Guthorm the Dane in 870 A.D. Then came the attack on Wessex. Defeated at Reading, the Wessex men, with whom were Alfred and King Ethelred, his brother, met the foe again four days later, and won the glorious victory of Ashdown, not far from the 'royal vill' of Wanating (Wantage) where Alfred was born. Ashdown was Alfred's victory, achieved in spite of the refusal of Ethelred to come away from hearing mass when fighting began. In a fortnight came the drawn battle of Basing, and soon after the hard-contested field of Merton, won by the Danes. Ethelred then died, early in 871 A.D., and Alfred, now the only possible King of Wessex, hurried from burying his brother at Wimborne minster to make a muster and a stand against more Danes just swarming in upon Reading. His previous army had melted away and were tilling their fields, and gathering a new one caused a month's delay, after which Alfred was badly routed at Wilton; so badly, that he bought off the Danes. But they did not keep faith and would not 'stay bought,' so that the endless struggle, with cruel and incessant ups and downs, went on indefinitely. Its further details shall not be given here. We have indeed Alfred's own authority for shirking such tedious minutiae of wars, for in his *Orosius*, toward the close of the fifth book, he suddenly takes the bit into

his mouth and runs away from his account of Roman warfare, remarking somewhat abruptly: "I shall grow weary of these Roman wars." Indeed, already as early as the fourth book, at the close of its eleventh chapter, he shows palpable signs of restiveness, where he says: "And there were many wars in those days in many lands, which it is now too tedious to relate."

During the first eleven years of his reign, Alfred was never sure of his life. Before then, he and his brother Ethelred altered their disposal of the family property for the avowed reason that they were in hourly danger of slaughter. No wonder then that Alfred was so appealed to by the tale of Damocles and the sword suspended over him by a thread that he interpolated it the twenty-ninth chapter of his *Boethius*, although *Boethius* has no mention of it. "Therefore," says Alfred, "a certain king formerly said: 'O, how happy he over whose head hangs not always by a small thread a naked sword, as over mine it ever yet has done.'" Alfred's catastrophe came like a bolt from the blue in 878 A.D. The Danes "stole away to Chippenham," says the *Old-English Chronicle*, "and overran the land of the West Saxons." Many were driven beyond the sea, "and of the remainder, the greater part they subdued and forced to obey them, except King Alfred." This was the moment when Alfred fortified himself in the wilderness of Athelney, a marshy district on the Parret, where he afterwards founded a monastery, not far from Glastonbury. It was in these parts, indeed, that 'Alfred's Jewel' was found in the 18th Century.

The reason why Alfred suddenly took to the woods must have been due to the very same cause which kept him waiting a whole month after Ethelred's death before engaging the Danes. His levies melted away after the expiration of two or three months' service, whereas the Danes had nothing to call them home; summer and winter through it was their only concern to fight and plunder. And thus we see that Alfred's darkest trial came to him through the

same insurmountable difficulty which our own Washington had to encounter, and that the same cause which drove Alfred into hiding came within an ace of ending our War of Independence, with independence yet unachieved.

All manner of legends center around Alfred's twelve-month spent at Atheleney. The tale of the burnt cakes is only one of several. But these myths need not detain us. Here however is the opportunity for noting how keen and genuine was the feeling for the woods and for every subtle change in the growth of plants and trees, which Alfred gained, presumably in this long period of hiding. The evidence of this we again find in a passage where he parts company with Boethius, interpolating the following. "Why may'st not thou perceive that all the part of a tree that waxeth in twelve months beginneth its upward growth from the roots into the trunk, and then along the pith and along the bark to the head, and thereupon through the boughs until it springs out in leaves and in blossoms and in fruits. . . . This thou mayest observe, how trees on the outside are shielded and clothed with their bark against winter and stark storms; and also against the sun's heat in summer."

Alfred's proceedings when he extricated himself from the wilderness and reassembled his men, leading them to a decisive victory at Hedington, or Edington, in Wiltshire, after mustering them on the verge of Selwood forest, are rather oddly explained by Pauli. A tower has been erected in our times on a hill not far from Wincanton, known and seen far and wide as Alfred's tower, to mark the neighborhood where Alfred's newly heartened forces gathered around him when he emerged from hiding at Athelney. The actual gathering-place was Egbert's stone, now Brixton-Deverill, in Wiltshire. Pauli says that Alfred "doubtless unfolded his standard—that golden dragon which once shone in battle against Mercians and Britons." The dragon of Wessex no doubt sounds well in opposition to the raven on the opposing Danish standard, but Alfred is rather

unlikely to have kept such a thing about him in the wilds of Athelney: it seems plausible to assume rather that he summoned all-comers by sounding something like a horn. There is in the laws of Ina, a noteworthy predecessor of Alfred on the Wessex throne, a severe penalty enacted to meet the case of anyone lurking near a settlement without notifying his presence by sounding a horn. For Alfred's purpose, however, something capable of carrying further than an ordinary horn would be needed. Such is the 'blowing stone,' shown to-day at the front of a wayside inn near Uffington-Castle and the 'White-horse hill' in Berkshire, the county of Alfred's birth. It is an erratic boulder like many a one scattered on the hills in these parts—the people call them sarzan-stones. This particular stone has curious cavities in it, and a very moderate blast, blown by a girl of twelve into one of its orifices, produces sound of just the quality and carrying power possessed, as ocean voyagers know to their cost, by the fog-horns used on North Atlantic liners. Some analogous instrument for assembling a host would have suited Alfred's emergency better in every way than the Dragon of Wessex, for he needed any men he could gather, Welshmen and Britons quite as much as Englishmen, and only the latter could have cared to rally round the Dragon of Wessex.

We may, then, think of Alfred and his call to arms at Egbert's stone as we think of Ehud at Seirath, where he "blew a trumpet in the mountain of Ephraim, and the children of Israel went down to him from the mountain, and he before them." It was certainly quite in character and suitable to the emergency, if Alfred said to his men of the heathen Danes, as Ehud to Israel of the Moabites: "The Lord hath delivered your enemies into your hand." This whole chapter in Alfred's history was such as to efface the long-standing enmity between Welsh and Saxons that had paralyzed his earlier struggles against the Danes. While at Athelney, Alfred was in just the situation long familiar to the Welsh in their desperate struggles against the

Saxon invaders. Indeed, Alfred's whole experience at this time, including its triumphant issue, was foreshadowed two hundred years beforehand in the adventures of Caedwalla, a Welsh-Saxon or Anglo-Celtic adventurer who long lurked in hiding a good deal to the north and east of Athelney, in the forests of Chiltern and Andred, and finally emerged to become King of the West Saxons and receive a regularly framed Saxon genealogy showing his descent from Woden through Cerdic, just what Alfred's was made out to be.

Alfred's splendid rally and victory at Wiltshire by no means relieved him of farther trouble with the Danes, but never again was he at their mercy. Until his death,—which occurred just about a thousand years ago, so that its millenary is to be celebrated at Winchester in October, 1901,—he went on steadily growing more and more capable of coping with them. He developed a well considered scheme of land-tactics, and also boldly coped with them on the sea, so that, in 897 A.D., four years before his death, he was sure enough of himself and of his power to treat a band of Danish pirates, captured off the Isle of Wight, as common malefactors. They were hanged at Winchester. His policy before this also bore fruit in the conversion of many Danes to Christianity. It is, in fact, abundantly evident that Alfred's tenacious resistance, coupled with his genuinely Christian policy, was the chief cause by which the heathen Danes first ceased to be a menace to the rising fabric of Christian civilization. If Charles Martel by his single victory at Tours rolled back the threatening flood of Mohammedanism and saved the beginnings of Western civilization the generation before Alfred, the danger from the north which came in Alfred's time was scarcely less serious, and that was first met by Alfred's stern resistance. His high resolve and unflagging persistence in England began that transformation of the heathen Danes, as the result of which they finally took their apportioned place in France, in Sicily, and in the Levant, as well as in Britain, and

became at a critical period the standard-bearers of Christendom and the West against the East. How completely the fusion between the Old-English and the Danes was ultimately accomplished is proved by the fact that Knut, the great Danish successor to the power consolidated by Alfred and his son, and long wielded in England by their posterity, solemnly reënacted Alfred's laws more than a century after Alfred gave them.

In Alfred's laws one feature intimately concerns us Americans, because it foreshadows the mood of our earliest New England lawgivers. The same implicit belief in a direct government of all earthly commonwealths by God Almighty led John Eliot to take his Christian Commonwealth straight from Holy Writ, and prompted Alfred to open his laws with a translation into Old-English of the Ten Commandments, of various passages in Exodus, of parts of the Acts, and of the Golden Rule from St. Matthew's Gospel. But Alfred had the additional motive that there was in his day no Old-English version of Holy Writ, so that the biblical preamble to his laws supplied a very real requirement of his people. How real we may judge from William of Malmesbury's saying that Alfred "enacted his laws amidst the clash of arms, and while trumpets were sounding for the fray." Alfred's Saxons needed a strict reminder that they were Christians, in their desperate struggles against the Danes, and that Alfred's well-chosen extracts from Holy Writ supplied.

King Alfred, then, surnamed the Great in the days of our Puritan forefathers, is not the hazy and mythological personage which foolish laudation, and over-anxious carping are conspiring to make of him. He is the first historical figure in Old-English or Anglo-Saxon annals of whom we can form a clear picture, and with whose ideas, apart from several grotesque superstitions of his, such as the idea that Mt. Etna was hell-fire and that its flames had been moderated since the birth of Christ, we can sympathize. It will

certainly be a healthy result of the present millenary revival of interest in the ideals of the Old-English, if we learn to prize and to heed the lessons contained in the life of one who, in a very real sense, was the father and founder of a great race, the first exemplar of virtues held in high esteem the world over; nowhere more than in England and America, whose political, social, and educational institutions still embody so much of Alfred's spirit.

But an interest attaching to our very institutions and rooted in our very national life and history can hardly be deep-rooted and durable, unless, as in the palmary case of the Sons and Daughters of the Revolution, it bears fruit in some tangible act. Let our interest have its upward growth, in Alfred's own words, "from the roots into the trunk, and then along the pith and the bark to the head, and thereupon through the boughs until it springs out in leaves and in blossoms and in fruits." There are two things to be done; one by all Americans, of whatever descent, and that is to read the most permanently valuable of Alfred's books, his translation of Boethius *On the Consolations of Philosophy*, now widely accessible in modern English. This book, though its popularity was greatest in the early Middle Ages, when English, Germans, French, Italians, and Jews vied with one another in explaining and translating it, and revered its authority as next to that of Aristotle, was translated by Chaucer about 1382 A.D. and printed by Caxton about 1480. Queen Elizabeth herself seems to have tried her hand at translating it, and Shakspere not infrequently seems to be almost quoting from it, so that its worth is proclaimed by all nations and many generations. The special merit and interest of Alfred's version springs from his simplicity of heart and fresh enthusiasm for Christianity, which make of it as rendered by him a new revelation of Eternal Truth and Righteousness. This is especially its effect in these latter days when we are jaded in mind by the prevalence of religious doubting and theological hair-splitting.

The second thing which might be done by all Americans of Welsh, English, or Scotch extraction, would be to join hands with the English committee in celebrating the millenary of Alfred's death at Winchester, next October year, and contributing to the memorial there to be erected.

IS THERE A PRIMORDIAL ATOM?*

By PERCIVAL LEWIS.

From the early part of the present era until the beginning of the sixteenth century—during the age of alchemy—the belief in the possible transmutation of one element into another was generally held. The alchemists did not succeed in their attempts to transmute the baser metals into silver and gold, but their efforts served a nobler purpose in laying the foundations of the modern science of chemistry. The old alchemistic idea has, however, never completely died. Sir Isaac Newton and Sir Humphrey Davy did not consider it absurd. In the more general form, that all matter may possibly be constructed out of a common basis, it has been held by many eminent chemists and physicists down to the present day.

The ideas of the ancient philosophers as to the ultimate nature and structure of matter were so vague and purely speculative that they scarcely deserve consideration from the scientific standpoint. The atomistic hypothesis was first put on a sound basis in the early part of this century by John Dalton, who showed that it furnished the simplest explanation of the fact of chemical combination in multiple proportion. There seems to be no escape from the conclusion that in all chemical reactions simple indivisible units take part—but there is no necessity to assume that these

* Abstract of a lecture before the Science Association, September 12, 1906.

bodies, which are, from the chemical standpoint, ultimate units, may not be capable of physical subdivision. A human being is the ultimate unit of society, but is nevertheless capable of physical subdivision. According to the hypothesis of Herbert Spencer, all material substances are resolvable into the so-called elementary substances composed of molecular particles of the same nature as themselves, but these molecular particles are complicated structures, consisting of congregations of truly elementary atoms, identical in nature, and differing only in position, arrangement, motion, etc., and the molecules or chemical atoms are produced from the true or physical atoms by processes of evolution, under conditions which chemistry has not yet been able to reproduce—neither can chemistry dissociate them.

It is difficult to conceive an atom so constituted as to fulfil all the necessary physical and chemical conditions imposed upon it. In Lord Kelvin's vortex-atom theory of matter we see an only partially successful attempt to construct all kinds of matter out of a common basis—the universal ether—and to account by purely mechanical considerations for all the properties of matter.

The earliest working hypothesis derived from the assumption of the unity of matter was that advanced by the English chemist Prout, in 1815. Observing that the atomic weights of the elements, as known in his time, were very nearly whole numbers as compared with the atomic weight of hydrogen, he assumed that the hydrogen atom is the ultimate unit out of which all other kinds of matter are constructed. More exact determinations of the atomic weights of the elements made by Berzelius and other chemists completely disproved this hypothesis, without proving, however, that chemical atoms may not be built up of some still smaller unit than the hydrogen atoms.

It was later discovered that we may group the elements in such a way that between the members of each group certain empirical relations of atomic weights and of chemical and

physical properties exist, which strongly suggest a family relationship. For example, it was pointed out by Döbereiner, in 1829, that in the case of many elements which have physical and chemical resemblances the atomic weight of one is the arithmetic mean of that of two others. The atomic weight of sodium is 23, the arithmetic mean of 7 and 39, the atomic weights of lithium and potassium respectively. This rule holds good in a surprising number of cases.

A further advance was made later by Newlands, Lothar Meyer, and Mendelejeff, who pointed out that if the elements be arranged in the order of ascending atomic weights in rows of seven, each row under the preceding (with a few gaps to ensure similar elements coming under each other), all the elements in the vertical columns would exhibit similar properties. For example, all the alkali metals, lithium, sodium, potassium, rubidium, and caesium, fall in such a column. This periodic system (so called from the periodic recurrence of similar elements when arranged in the order of their atomic weights) has been fruitful of results. Several new elements suggested by gaps in the original table have been actually discovered, and it has also been useful in fixing the true atomic weights in cases where several possible values are found.

Such relationships are, with our present knowledge, purely empirical, and while they strongly suggest either a similar geometrical construction of the atoms in a related group (involving dynamical similarity), or a common basis, they have no obvious and complete physical explanation.

Similar empirical relations may be found by spectroscopic means. If light from an incandescent solid passes through a prism from a narrow slit and is focused by a lens, the different colors, or waves of different length, will be refracted differently by the prism, and a continuous spectrum will be formed, consisting of an infinite number of adjacent images of the slit, corresponding to the infinite number of colors in the light of the solid. Luminous gases or vapors,

on the other hand, emit only a finite number of colors, and, therefore, give a discontinuous spectrum, consisting of a finite number of separated images of the slit in different colors. Each element has its own characteristic spectral lines, the positions of which are not duplicated by those of any other element. We assume that the vibrating molecules of the solid are so near as to interfere with each other's free vibrations, and cause a confused optical "jangle" of all vibration frequencies, which they communicate to the surrounding ether. A compound, when not heated beyond the dissociation point, gives a complex banded spectrum, which we associate with the idea of a complex molecule, while the elementary gas or vapor, the molecules or atoms of which are sufficiently far apart not to interfere with each other's free vibrations, gives a simple line spectrum, which we attribute to the atomic state—for we may assume that at very high temperatures many molecules of a gas may be dissociated into their constituent chemical atoms. Each line must correspond to an atomic vibration of a given frequency, and if a single iron atom can give something like ten thousand spectral lines it means that it is capable of that many kinds of free vibration, and must, therefore, be very complex in structure. Imagine the complexity of a musical instrument which can give ten thousand distinct notes—a piano of ten thousand strings! Is it not more reasonable to assume that there may be many degrees of atomic subdivision, each accounting for a single group of a few lines in a given spectrum? The possibility of such subdivision is strongly indicated in the case of mercury, for example. Chemically, the vapor of mercury is monatomic. When made luminous by the ordinary electric discharge it gives a simple line spectrum, as we might expect; but when a very powerful electric discharge passes through it a highly complex spectrum, consisting of thousands of lines, is observed. As in the case of iron, an enormous complexity of atomic structure must be assumed to account for so many modes of vibration in a single body.

That groups of lines exist corresponding to various degrees of atomic complexity, each group due to a particular aggregation of elementary units, is indicated by the spectra of many elements, in which, as shown by Balmer, Kayser and Runge, and others, certain groups or series of lines are found, in each of which the lines are physically similar, that is, are sharp or diffuse, or vary in appearance in the same way with changes in temperature or pressure. Furthermore, the lines in a given group have a definite empirical mathematical relation between their wave-lengths, which does not exist between the members of different groups. Such considerations give great weight to the probability of atomic dissociation under the influence of high temperatures or powerful electric discharges.

It is found also that the spectra of the elements in a given periodic group frequently contain corresponding groups with similar appearance, but displaced in position toward the red end of the spectrum (the region of slower vibrations) with increasing atomic weight. This strengthens the idea of relationship implied by the periodic law.

Lockyer first stated the idea of dissociation into atoms of lower order, which he based largely on the occurrence of "basic" or apparently common lines on the spectra of different elements. It has been proved, however, by the use of more powerful spectroscopes, that the supposed coincidences which suggested the hypothesis of basic lines were illusory.

The facts so far described are significant as indicating some relationship between the elements and a possible atomic dissociation. We may gain some further insight into the matter by considering the relations of matter to electricity.

There is strong evidence that in acidulated water or a solution of any metallic salt in water a certain proportion of the chemical molecules are always dissociated into their constituent atoms or compound radicals, each of which is charged with positive or negative electricity. Such charged

atoms or radicals are called ions. When an electric current is passed through such a solution, the electric forces cause the positively-charged ions to pass to the negative electrode, or cathode, the negatively-charged ions to the positive electrode, or anode, at which the ions give up their charges and recombine into chemical molecules. In this way the ions act as the carriers of the electricity through the solution. Faraday found that in a given time a given current will set free quantities of different substances which are proportional to the combining weights of these substances with hydrogen; or, in general, quantities which contain the same number of atoms. It follows that each ion, whatever its substance, transports the same quantity, e , of electricity. In general we have no exact means of determining the value of either e , the ionic charge, or m , the ionic mass (although a rough means of doing this will be referred to later), but it is evident that we may determine very exactly the ratio e/m , which is the same as E/M , where E is the total amount of electricity required to electrolyze M grams of the substance. In the case of electrolyzed hydrogen the value of e/m is about 10^4 . The quantity e is the same for all substances, and seems to be a fundamental and indivisible unit of electricity.

The transfer of electricity through a rarefied gas is apparently somewhat similar to that through a solution. At ordinary pressures the electric spark passes with difficulty, and in a violent disruptive way. If the pressure in a vacuum tube be reduced by an air pump to several centimeters of mercury, the discharge passes quietly, and a general glow is diffused through the tube. The appearance of the discharge at the two electrodes is somewhat different, but there is little evidence of any electrolytic separation in the case of a compound gas, such as carbon dioxide. The current seems, however, to be transported convectively by ions.

When the pressure in a vacuum tube is excessively small—say the millionth of an atmosphere—the appearance of

the discharge is entirely changed. It is, in fact, scarcely visible, but the glass walls of the tube are caused to fluoresce brilliantly with a green glow, especially in the regions opposite the cathode. It has been conclusively shown that this fluorescence is due to the impact of material particles projected from the cathode, or from the gas in its vicinity, with considerable mechanical force, as shown by the rotation of a vane placed in the path of the discharge. If these particles fall upon an insulated body it becomes charged with negative electricity, showing that the particles are themselves so charged. It was shown some years ago by Rowland that a statically-charged body moving with great speed behaves as an electric current. The conductor carrying the latter is, by reason of its magnetic field, acted upon by a magnet. We find, as we might expect, that the "cathode rays" are deflected by a magnet brought near the tube. This deflection must be proportional to the magnetic force, and to the quantity of electricity on each particle, and inversely proportional to the mass of each particle. We cannot determine either the charge or the mass separately, but if we measure the magnetic force and the deflection produced by it we can calculate the ratio e/m quite accurately. This has been done by Schuster, Lenard, J. J. Thomson, Kaufmann, and others, who have found consistent values ranging between the narrow limits, 3.6×10^6 , and 17×10^6 , and averaging about 7×10^6 . This ratio is, then, something like one thousand times greater than the ratio e/m found in the electrolysis of hydrogen. The same values are found whatever the nature of the cathode or of the gas contained in the tube.

There are probably positively-charged particles projected from the anode as well, but their magnetic deflection is almost inappreciable, and they move with much less speed than the negatively-charged bodies. For them the ratio e/m varies with the nature of the electrode and of the gas in the tube, and is of the same value as in the case of electrolysis. We might infer from this that the negatively

charged particles are much lighter than those charged positively, and that the difference in the values of e/m in the two cases arises from the differences in m .

Some years ago Zeeman, of Amsterdam, discovered that if an incandescent vapor is placed in a magnetic field, the spectral lines of the vapor are generally separated into several polarized components, indicating changes in vibration-frequency due to the magnetic force. Lorentz has explained how this may be due to the action of the magnetic field on charged particles, and the direction of polarization indicates that the light is due to negatively charged ions alone. From the amount of separation of the components the ratio e/m may be calculated, and Zeeman found it to be about 10×10^6 , very nearly the same value as in the case of cathode rays, while e/m in the case of the electrolytic hydrogen ion is only 10^4 .

The laws of chemical combination seem to indicate that m , the atomic mass of an element, is invariable; the facts of electrolysis indicate that e , the ionic charge, is likewise a fundamental and indivisible unit. In the case of the cathode rays and the Zeeman effect, however, it is evident from the high value of e/m that either e is a thousand times greater or m a thousand times less than in the case of electrolytic ions.

J. J. Thomson has recently put this question to a crucial test. It is easy to measure the total amount of electricity conveyed by a large number of ions, and if we could count the number of ions we could determine the ionic charge. This was the problem which Thomson successfully solved. It is impracticable to collect and count the cathode particles in a vacuum tube, but Thomson reached the same end in a different way. If ultra-violet light is allowed to fall on an insulated polished metal plate charged with negative electricity, the metal rapidly loses its charge, which seems to be conveyed to neighboring bodies by small material particles which are torn from the metal or the adjacent gas by the rapid vibrations of ultra-violet

light, and repelled by the electric force. Positive electricity is not so discharged. From the deflection of these particles by a magnetic field in a rarefied space Thomson found, as in the case of the cathode rays, that the value of e/m was 7.3×10^6 .

An ingenious method was adopted to count the number of the ions which discharged a negatively-charged plate. If a closed space saturated with water vapor be suddenly cooled, which can be accomplished by allowing the air with which the vapor is mixed to expand, the tendency of the vapor is to condense partially, provided some material nuclei, such as dust particles, be present. If such particles are not present, the vapor condenses with difficulty. It is found that charged ions also act as nuclei of condensation. Thomson placed some water in a closed vessel containing an insulated polished aluminium plate, charged with negative electricity. The cooling of the water vapor due to sudden expansion was not followed by condensation, showing that none of the requisite nuclei were present. Ultra-violet light was then allowed to fall on the plate. The latter lost its charge, and subsequent cooling of the water vapor was followed by the production of a cloud which slowly settled in the tube. From the rate of fall it was easy to calculate the size of the drops. Dividing the total volume of water condensed by the size of each drop, the number of drops, and hence the number of nuclei or ions, could be obtained. Knowing the total quantity of electricity discharged by all the ions, the value of the charge on each ion could be determined. In a similar manner Townsend, working with Thomson, had previously determined the charge e on each ion of freshly electrolyzed hydrogen. Thomson found that these two values of e were practically the same; hence the mass m in the cathode rays and in the discharge of negatively-electrified metallic plates must be less than the one-thousandth part of the mass of a hydrogen atom, in order that the ratio e/m may be more than a thousand times greater in one case than in the other.

These charged ions may be either metallic particles detached from the metals forming the cathode or the plate, or gaseous ions resulting from the dissociation of the surrounding atmosphere. In any case the mass m seems to be independent of the nature of the metal or the gas, and Thomson considers that we have here a state in which subdivision is carried much further than in the ordinary gaseous state, and one in which all kinds of matter are reduced to the same primordial condition. This is in agreement with the hypothesis of a fourth or "radiant" state of matter advanced by Crookes when he first began to study the phenomena in vacuum tubes at very low pressures.

Without going into any philosophical discussion as to the ultimate nature of matter, we may say that experimental facts indicate very strongly that the so-called elements may be compounds or aggregates of some more elementary units, which may themselves be complex. We may sum up this evidence by saying that the periodic law indicates some family relationships among the elements which may depend upon either a similar atomic form or a common material basis. These relationships are substantiated by similar relationships between the spectra of the elements in a given periodic group. As evidence of the complexity of the chemical atom, we find that the spectra of some elements which are supposed to be monatomic become entirely changed and more complex under conditions which would promote dissociation. Furthermore, in the spectra of many elements there are series or groups of lines which are physically similar and which have wave-lengths connected by mathematical relations, indicating groups of different degrees of complexity. In the case of cathode rays and the discharge of negative electricity by ultra-violet light, we find that the ratio e/m is more than the thousand times greater than in the case of the ions of electrolysis, while the value of e appears to be the same in the two cases; consequently, there seems to be strong evidence that the masses concerned are less than the thousandth part of the mass of

the hydrogen atom, the smallest body previously known to us. It is to be noted that these small corpuscles are found associated with negative electric charges only, as for a positive charge the ratio e/m always has its normal electrolytic value. This is a very significant fact, which may greatly modify our electrical theories.

We are justified, then, in concluding that there is some evidence for the existence of a primordial atom, or at least of atoms more elementary than those which take part in chemical reactions, and we have reason to hope that in the course of time we may acquire as definite information on this point as we have to justify our views regarding the chemical atom and the kinetic theory of gases.

THE POWER AND METHODS OF HEREDITY.*

By WM. E. RITTER.

I.

Heredity "is the biological law by which living beings tend to repeat their characteristics in their descendants." This definition is taken from Webster's Dictionary, and it is very good.

A statement about it that will serve the purposes of these articles somewhat better, however, than this definition, and that at the same time could not be objected to by rigid science, is as follows: Heredity is that in the nature of organisms by virtue of which they tend to reproduce their kind, and by virtue of which, also, they are never produced, either as wholes or in part, in any other way than by their kind.

Less than thirty years ago this would not have expressed the general teachings of biology on this subject.

That living things bring forth after their kind must have been one of the first phenomena to press itself upon dawning human intelligence. That, however, this is the expression of a universal law: that they bring forth absolutely nothing but their kind, and that they come forth in absolutely no other way than from their kind,—the finding out of all this has remained to be recorded as one of the triumphs of late nineteenth century biology.

Spontaneous generation, or archebiosis, and heterogenesis, or xenogenesis, are the terms that have generally

*A modification of a paper read before the Berkeley Club, of Oakland, September 27, 1900.

been used to express the supposed limitations to the law of heredity; the former applying, of course, to generation without parents; the latter to generation by the transformation of organisms into others of different kind. Both have prevailed, not only in popular belief, but in scientific teaching down to very recent times. In fact, they are not wholly dislodged from popular belief even yet. In the pine forest regions of northern Wisconsin, dense thickets of poplars, miles in extent, spring up where the pine has been destroyed by ax and fire. Twenty years ago inhabitants of those regions assured me with the greatest confidence that the poplars "grew spontaneously." "How else could they originate?" asked an intelligent mill-owner; "Nobody knows of any poplar trees in this portion of the state from which seeds could come."

And it was the general belief with the farmers of the same state among whom I lived that wheat, particularly winter wheat, turns into "chees."

In fact, one still hears the question, usually in rather skeptical tones to be sure, but still the question, as to whether it is really true that horse-hairs turn into worms! But the errors of science regarding these matters are more remarkable than those of popular belief.

Until near the middle of the seventeenth century no man of science appears to have ever doubted that animals of various grades might get into existence by a variety of ways; as eels and other fishes from slimy mud, insects from the vernal dew of plants, grubs from fruit in which they live, etc. About this time William Harvey, whose fame ought to rest almost as much here as on his discovery of the circulation of the blood, published his "Discourse on the Generation of Animals," wherein is enunciated his classic aphorism "*Omne vivum ex ovo*."

It is doubtful, however, if Harvey really intended entirely to deny spontaneous generation. Various passages in his treatise indicate that he used the word *Ovum* in a general sense, as meaning the "living principle," or

"primordium," which might arise "sponte et casu." Certain it is that he could not have meant by egg what we now mean by it, for the simple reason that the egg as we know it was wholly beyond the reach of the means of investigation at his command.

Indeed, some critics of Harvey's work have reached the conclusion that in reality he did not go much beyond Aristotle in his teachings on this subject. "Let us, therefore, say," he writes, "that that which is called primordium among things arising spontaneously, and seeds among plants, is an egg among oviparous animals." His essay abounds in the "vital spirits," "ingenerate heat," "generative contagion," "immaterial form," etc. that played so large a part in the speculative physiology of that period.

To Francis Redi, a Florentine physician, science owes the first genuinely sound, forward movement in this field. His is the glory of having substituted an experiment for speculation to find out how maggots occur in decaying meat. He put aside philosophizing for a little, and prevented the flies from "blowing" the meat. Having carried on this course of investigation for some time, he reached the conclusion that not only in this but in all like cases, animals are produced by parents. Quite in the true scientific spirit he did not, however, venture to go to the full extent of altogether denying spontaneous generation on the strength of his observations. He merely concluded that all life must come from already existing *living* things. He denied archebiosis, not, however, heterogenesis. He still believed that apple-worms, for example, are generated by the apples which they infest.

Redi's work caused much discussion, although little advance beyond his position was made for another hundred years. Then came that wonderfully acute experimental biologist, the Abbé Spallanzani, Professor of Natural History in the University of Pavia, who may fairly be said to have opened up modern investigation in this domain. (About 1750.) He made various infusions, subjected them

to high degrees of heat, sealed them while hot in glass flasks, and found that under such circumstances the usual organisms no longer appeared in them. And from his experiments he drew the conclusion that germs floating in the air are the source of the animalculæ that ordinarily appear in such infusions.

With this work the conflict which has raged until now, almost, began. It is of course impossible even to outline the history of it all here. It will be sufficient evidence of the difficulty of the subject to mention that through all the last half of the eighteenth and the first half of the nineteenth centuries the most distinguished physiologists and naturalists are arrayed about equally on opposite sides of it. If anything, the predominance of authority verges toward the affirmative. We find here, for example, such names as that of Johannes Müller, the founder of modern physiology; Lamarek, whose "*Philosophie Zoologique*," though published fifty years before the "*Origin of Species*" by Darwin, is at the present moment neck-and-neck with it in the race for favor among speculative biologists.

Belief in "archebiosis" and "xenogenesis" received about its last strong defence in "*The Beginnings of Life*," a work in two liberal-sized volumes written by Dr. H. Carlton Bastian, a Professor in University College, London, and a Fellow of the Royal College of Physicians and of the Royal Society of London. This was published in 1872, fifteen years after the appearance of Herbert Spencer's earliest essays on Evolution; thirteen years after that of the "*Origin of Species*;" and following by from one to fifteen years some of the most important works of Pasteur on fermentation and germ diseases. And of course Dr. Bastian was familiar with all these works. Indeed it was, as the author himself tells us, largely in response to the apparent demands of the doctrines of the Conservation of Energy and Organic Evolution that his investigations were undertaken.

After reviewing the work of Spallanzani, Ehrenberg, Pasteur, and others, who, on both experimental and

theoretical grounds had rejected the doctrine of "archebiosis," Bastian declares: "The experimental evidence which I have brought forward not only goes to prove that living matter may originate in this natural manner, but that, like other kinds of matter, it comes into being by virtue of the operation of the same laws and molecular properties as suffice to regulate its growth."

And regarding Heterogenetic Transformations, he affirms "that both among the lower living things and in portions of higher ones these have been almost as well attested as the occurrence of allotropic and isomeric modifications amongst different kinds of not-living matter."

The second volume of the work is devoted chiefly to the author's own investigations—the methods employed, his observations, and his deductions. He worked much, as his predecessors and contemporaries had done, with various vegetable infusions; and he describes and figures in great detail the formation of the "primordial mucus;" then the differentiation of this into "embryonal areas;" and finally the gradual production in those embryonal areas of many kinds of monads, amoebæ, fungi, etc.

Cases of heterogenesis he details even more numerously and fully, if anything, than those of archebiosis.

Euglena, the "red-eyed animalcule," for example, he finds may transform itself into any one of the following animals: vorticella, rotifer, tardigrade, nematode. The euglenæ, in turn, arise from various algi filaments. So it comes about, this being interpreted in more familiar terms, that from a single low plant there may arise by direct transformation, five different animals, representing four of the chief subdivisions of the animal kingdom. And this on the authority of a learned professor of biology still living!

The doctrines of biogenesis and homogenesis have finally completely triumphed through the rigid application and the perfection of the methods introduced by Spallanzani one hundred and fifty years ago. The names of Pasteur, Tyndall, and many others, have become familiar in this

connection. But particularly has the employment of these methods in the arts and sciences, as in the preservation of fruits, in antiseptic surgery, and in a hundred other phases of bacteriological practice, brought the great truth home, both to science and popular intelligence. Every housekeeper now knows that if her fruit has been heated hot enough and is sealed absolutely air-tight no fermentation will take place in it; and everyone knows that suppuration never occurs in wounds from which germs have been wholly excluded.

So far, then, as concerns the coming into existence of individual organisms, present day science holds the law of heredity to be universal. Living things reproduce nothing but *their kind*, and are produced in no other way than by *their kind*. But,—an organism may be of the *kind* of another and still not be exactly like it. Indeed, no two organisms, not even parent and child, are ever exactly alike. They always differ in some measure. Furthermore, no organism is precisely the same thing at any two instances in its own individual life. Change and variableness are likewise universal in the living world.

The grand total of our results is, then, that organic nature is under the dominion of two universal laws that oppose each other. So it is. On the one hand, there is ceaseless change; there is unlimited variableness. This is the very quintessence of the phenomenon we call life. The primordial organic substance, the protoplasm, is alive just in virtue of the fact of its chemico-physical instability. Its highly but loosely organized chemical compounds are ceaselessly breaking down and setting free their stored-up energy, and are as ceaselessly building themselves up again. Change, I repeat, is the very quintessence of life. And living beings, however complicated and exalted in rank they may be, never escape the qualities stamped upon them by the primal stuff of which they are composed. This is the *dynamic* side of the living world. On the other hand, there is the universal tendency to fixedness. There

is, through extraneous physical conditions, as nutrient material, moisture, temperature, other impinging bodies, etc., mass-limitation to this ceaseless play of force on the dynamic side. In other words, this play is restricted to *bodies*, to *forms*. But *form* is wholly inert. It is a clog upon activity, as one might say. Here we have the *static* side of the living world. This is heredity. The law of heredity is therefore a law of passivity. The force of heredity is a negative force, if indeed it may be called a force at all. What in reality we mean by the force of heredity is the persistence of the type-form that has been engendered by the limitation to the play of forces on the dynamic side of life, through the sum total of conditions under which life exists. It is very important to remember this. There is no biological warrant for the supposition of a real force the business of which is to shape organisms into specific forms. It is undoubtedly true that many expressions may be found in recent writings by good authorities that seem to imply such a force. But they either do not convey the writers' exact meaning, or they arise from misconceptions. The only forces inherent in organisms are those concerned in the metabolic processes of protoplasm; and these have no form-producing capabilities in themselves whatever. They are the same in all creatures however diverse in form. The creature in itself merely grows and varies and acts. The specific attributes that it has are the result of the extraneous conditions which it and its ancestors have grown and acted *against*.

Having now reached a clear conception of the fundamental nature of heredity, we are in position to consider its power and mode of operation.

As almost all the popular interest in heredity centers about the question of the transmissibility of so-called acquired characters, we may as well fix upon this as the focal point of our further discussion. And in the first place we must define some terms. All the parts and attributes of an organism are characters. These are of many

grades. Man, for example, has his individual characters, or those which distinguish him from all other individual men; his specific characters, or those which he possesses in common with all other individuals of his species, but which are possessed by no other species whatever; his generic characters, or those which make him belong to the genus *Homo*; his class characters, as his mammary glands, his hairy body, his single aortic arch turning to the left, etc., which mark him as a member of the class mammalia; and so on. If we locate him definitely in the zoölogical scale we shall have to make use of all his parts and attributes; *i.e.*, all his characters. I have dwelt upon this because most persons do not, apparently, think of the matter in this broad way, particularly when questions of heredity are being discussed.

Now the mere statement of the fact that man has been evolved from some creature vastly simpler than he is, is equivalent to saying that his characters have all been *acquired* in some way and at some time. In the course of his individual development, beginning with the simple egg, he takes on one by one, or acquires, all his characters; and likewise in his racial development, or phylogeny as we say, they have all been taken on one after another. He has no characters that are not acquired. Obviously, therefore, the question is not in reality whether acquired characters are transmissible, but rather whether characters acquired in some particular way and at some particular time are transmissible.

It is advantageous to observe that all the characters of an organism may be placed in two great categories, *viz.*, those which come from its ancestors, and those which do not; those which are in the nature of the organism, and those which come from the exterior. The first kind are in the blood, so to speak, while the second kind are imposed upon the being wholly from without, and consequently pertain to its own individual life-time alone.

The first we may call ancestral characters; the second,

extra-ancestral. To the first belong, of course, the vast majority—probably nine hundred and ninety-nine thousandths—of all the characters. All class, ordinal, generic, specific, and most of the individual characters belong here. To the second belong the few, say the remaining one thousandth; and these are all individual.

Now it is this second small group of characters that the term acquired, as ordinarily used, relates to. And it is with reference to these alone that there is question about transmissibility. No one with any authority to speak on the subject at all has ever for a moment either thought of so limiting the definition of heredity that it should not apply to the first group, or doubted that all the characters belonging to this group are transmissible. It is difficult to understand how so many educated persons have become confused on this point, and I should not have believed such a thing possible. The frequency, however, with which I am asked if I "believe in heredity," or whether I "believe in heredity, or environment" indicates that the misconception is widespread.

The terms which we use having now been defined, we may see what we can make out of the question of the transmissibility of acquired characters.

MRS. JANE KROM SATHER'S GIFTS TO THE UNIVERSITY OF CALIFORNIA.

At a meeting of the Regents on October 8, 1900, the President announced the gift to the University, by Mrs. Jane Krom Sather, of money, stocks, and real property of the value of nearly \$100,000, for the endowment of a Jane K. Sather Chair and the establishment of a Jane K. Sather Law and Library Fund. Regent W. H. L. Barnes expressed on behalf of the Regents the deep appreciation of Mrs. Sather's munificence felt by all the members of the University, and by every friend of education. Resolutions accepting the gift and thanking Mrs. Sather were adopted as follows:

"WHEREAS, Jane K. Sather has offered certain gifts to this corporation for certain purposes and trusts, and upon certain conditions, by a written communication in the following language:

SAN FRANCISCO, CAL., October 8, 1900.

To the Regents of the University of California,

GENTLEMEN:—As a resident of the State of California, and one who is deeply interested in its welfare, I am desirous of encouraging and assisting the work of liberal education which is now being carried on by the University of California. For this purpose I offer you the following property:

Cash	\$28,000 00
Two hundred shares of the stock of the San Francisco National Bank, of the value of.....	20,000 00
One hundred shares of the stock of the Fireman's Fund Insurance Company, of the value of.....	21,000 00
Real estate in the town of Ashland, Oregon, of the value of.....	6,000 00
	\$75,000 00

This property I offer you as a corporate body, upon the following conditions and for the following purposes:

That it, or its proceeds, be held by you as a separate and perpetual fund, the income whereof shall be paid to me quarterly during my life, and after my death shall be devoted by you to the perpetual support, maintenance, and equipment of such chair in a department of classical literature at the University of California as you in your discretion see fit to establish for this purpose; such chair to be known as the Jane K. Sather Chair, and such fund as the Jane K. Sather Chair Fund. You are to have full and unrestricted rights of control, disposition, and ownership of the property constituting such fund, having in mind always the purpose of maintaining a perpetual fund properly invested so as to yield an income for the purposes heretofore mentioned.

I also offer you the following real property in this State:

First: The premises in the City of Oakland forming the northwest corner of Jefferson and Ninth Streets, with a frontage of seventy-five feet on Ninth Street and one hundred feet on Jefferson Street.

Second: The premises in the City of Oakland on the west side of Broadway, thirty-four feet north of Delger Street, with a frontage of thirty-three feet and a depth of one hundred and thirteen feet, six inches.

Third: The premises in the City of Oakland on the westerly side of Broadway Street, one hundred feet north of Delger Street, with a frontage of fifty feet and a depth of one hundred feet.

Fourth: The premises in the City of Alameda on the easterly side of Park Street, fifty feet south of Webb Avenue, with a frontage of fifty feet and a depth of approximately one hundred feet.

This property I offer to you as a corporate body upon the following terms and conditions:

That you have the full and unrestricted rights of control, disposition, and ownership of this property, or the proceeds of it, but that during my life you are to hold it, or the proceeds of it, as a separate fund, and keep the same invested according to your discretion so as to yield as large and steady an income as is possible consistently with safe investment, and pay the income to me quarterly. After my death, so much of said property, or the proceeds of it, as amounts in your judgment to the sum of Ten Thousand Dollars (\$10,000) shall be by you set aside and held as a separate and perpetual fund to be known as the Jane K. Sather Law and Library Fund, the income whereof shall be devoted by you to the perpetual support of a law library at the University of California by way of the purchase of law books and publications.

In case any of said property, or the proceeds thereof, remains after setting aside therefrom the fund just mentioned, such remainder shall, up to the amount of Ten Thousand Dollars (\$10,000) be expended by you in the purchase of law books and publications for the purpose of establishing, adding to, or maintaining a law library at the University of California. The times and occasions for expending this sum, or any portion or portions of it, shall be entirely within your discretion; and waiting the proper time and occasion for such expenditures you shall have the right to invest and accumulate the said sum, or the property representing it. Each book or publication purchased with those gifts, or the proceeds thereof, shall be plainly stamped with a suitable device expressing that the same has been purchased with funds donated by me to the University of California.

In case any of said property, or the proceeds thereof, remains after setting aside the two foregoing sums of Ten Thousand Dollars (\$10,000) each, then such remainder shall be devoted by you in such manner and at such times as you deem best to the advancement and support of the teaching of law at the University of California, in which case I ask you to take such means of permanently acknowledging this gift as you may deem advisable.

Upon receiving word from you of your acceptance of these gifts upon the conditions and for the purposes set forth, I will deliver to such officers as you may designate to receive the same and give a receipt therefor in your name and on your behalf, proper instruments of transfer to you of the property specified.

With the sincere and deep hope that these gifts may be a source of great good to the University, and through it to the State, I remain,

Yours very respectfully,

JANE K. SATHER.

"AND WHEREAS, It is deemed for the best interests of the University to accept this very generous offer,

"Now therefore, be it resolved: That said offer be and is hereby accepted by this corporation and that the property offered be taken, received, held, managed, and invested, and the proceeds thereof used, bestowed, and applied by this corporation for the purposes and trusts and upon the conditions prescribed in said communication, and that the President of the University and the Secretary of this corporation be authorized in its behalf to receive the property so offered and the instruments of transfer and evidences thereof, and to give a receipt therefor in the name of this

corporation and under its seal specifying that the said property is accepted by this corporation upon the conditions and for the purposes and trusts specified in the said communication.

"*Be it further resolved:* That the President of the University and the Secretary of this corporation be directed and authorized to transmit to Mrs. Sather a communication in the behalf of this corporation and under its seal, informing her of the acceptance of her offer and embodying these resolutions."

A gift of \$10,000 by Mrs. Sather for the establishment of the Jane K. Sather Library fund was made public in the following letter:

OAKLAND, Cal., October 27, 1900.

Benjamin Ide Wheeler,

President University of California,

MY DEAR SIR:—I give and deliver to you as representative of the University of California the following duly endorsed promissory notes of F. M. Smith:

\$5,000.00. October 10th, 1896, interest at 6% per annum,
\$5,000.00. October 13th, 1896, interest at 6% per annum,
with collateral, Certificates Nos. 441 and 442 for one hundred shares each of the Pacific Coast Borax Co.

This gift is for the establishment of a fund, the income of which is to be used for the purchase of books for the Library of the University of California. The gift of these two notes is absolute and I shall hope to receive a formal acknowledgement of this gift from the Regents of the University whenever it shall be convenient.

Yours very sincerely,

JANE K. SATHER.

At the University Meeting on Friday, November 9, the President announced Mrs. Sather's third rich gift to the University. He said that she had executed a deed conveying to him in trust real property in Oakland which upon her death is to be sold and the proceeds applied in accordance with instructions contained in a sealed letter now deposited in escrow in an Oakland bank. The method of administration of the trust is not yet known, but it is understood that Mrs. Sather's last gift is a most generous addition to the beneficences which she has hitherto bestowed upon the University.

OFFICIAL ACTION.

At a meeting of the Regents held October 9, in accordance with the recommendations of the President, Dr. H. L. Ryfkogel was appointed Professor of Pathology and Applied Microscopy in the Post-Graduate Medical Department, Dr. R. Beverly Cole was appointed Emeritus Professor of Obstetrics and Gynecology in the Medical Department, and Dr. Beverly MacMonagle was appointed Lecturer on Gynecology in the Medical Department.

At a meeting of the Graduate Council held September 28 the Secretary announced that the President had appointed the following committee on the Association of American Universities: Professors Leuschner, Clapp, Hilgard, Stringham, and Howison.

At a meeting of the Graduate Council held September 28 the Secretary read the following report:

The Committee of the Graduate Council on the Library recommends the adoption of the following rule subject to the approval of the Board of Regents:

Persons resident in Berkeley, who may desire to pursue courses of reading or study without becoming members of the University, may have full student privileges in the Library, provided each application for such privileges be endorsed by two members of the Academic Senate, and be accompanied by a deposit of ten dollars in the office of the Secretary of the University. In each case such deposit, less charges for damage and loss of books and fines for violation of rules, shall be returned to the depositor, when he no longer desires to use the Library. Such privileges shall lapse on the 30th day of June of each year, but may be renewed on application to the Librarian.

For the Committee,

THOS. R. BACON.

This was adopted without dissent, and the action of the

Graduate Council was communicated to the Regents by the President at the meeting of October 9. On his recommendation the matter was referred to the Committee on Library and Museum with power.

The following committees of the Academic Council have been announced for the academic year 1900-1901:

1. Military Department and Gymnasium: Professors Waite, Edwards, Magee;
2. Regulations: Professors Stringham, Hilgard, Slate, Merrill, Hengstler;
3. Examination of Schools: Professors Slate, Brown, Bradley, Merrill, Babcock, Setchell, Stringham, Paget, Kower;
4. Recommendations for Teachers' Certificates: Professors Brown, Lewis, Richardson;
5. Scholarships: Professors Wickson, Brown, Senger, Stratton, Sanford;
6. Frank J. Walton Memorial Loan Fund: President Wheeler, Professors Bacon, Bradley, [to serve until 1903-1904];
7. Schedule of Exercises: Professors Haskell, Leuschner, Page;
8. Applications for Admission: Professors Senger, Cory, Armes;
9. Credentials: Professors Merrill, Cory, Haskell;
10. Study-Lists: Professors Richardson, Merriam, Babcock, Raymond, Whitney;
11. Special Students: Professors Bradley, Christy, Putzker, Loughridge, O'Neill;
12. Students' Affairs: Professors Bacon, Ritter, Edwards;
13. Athletics: Professors Edwards, Bacon, Clapp, Mr. Hunt;
14. Course Preparatory for Medicine: Professors Ritter, O'Neill, D'Ancona, Jepson, Dr. Bancroft;
15. Commencement Exercises: Professors Soulé, Setchell, O'Neill, Magee, Mr. Maybeck;
16. Classification: Letters, Social Sciences, Natural Sciences, and Commerce: Professors Gayley, Slate, Clapp.

At a meeting of the Academic Council held September 14, Professor Merrill, on behalf of the Committee on University Colors and University Flag, reported that, after conference with the President of the University, blue and gold had been selected as the University colors, and that ribbons showing the proper shade had been deposited at the Coöperative store.

At a meeting of the Academic Council held September 14 the Committee on Scholarships reported recommending the appointment of the following to fill vacancies caused by resignations: Elizabeth Smith Wetmore, State of California Scholar, Second Congressional District; Mary E. A.

Gray, State of California Scholar, Fourth Congressional District; Minna H. Nelson, Levi Strauss Scholar, Sixth Congressional District.

At a meeting of the Academic Council held November 16 Oney McCutchan Nicely was appointed a Levi Strauss Scholar from the Sixth Congressional District to fill a vacancy caused by resignation.

At a meeting of the Academic Council held November 19 the following resolution was adopted:

That it is the sense of the Academic Council that the curriculum of the College of Commerce be laid out on the model of the technical colleges rather than on the model of the colleges of general culture.

It was further voted that the President appoint a new special committee to arrange a curriculum for the College of Commerce with a view particularly to its proper relation to the other colleges of the University. The President appointed Professors Page, Gayley, Stringham, Leuschner, Cory, Ritter, and Slate.

At a meeting of the Academic Council held November 19 the following resolution was adopted:

Entrance examinations will be held in August and January of each year. The January examinations are primarily for the purpose of enabling students in the University to remove deficiencies incurred in the previous entrance examinations, but they may be taken by applicants not enrolled in the University who may present certificates from their teachers that they are prepared in the subjects they offer.

CURRENT NOTES.

As a result of his publications on dietetics and agricultural chemistry, Assistant Professor Jaffa has been appointed special agent and food expert in the Division of Chemistry of the United States Department of Agriculture.

Before the Geometry section of the International Congress of Mathematics, held at Paris in August, Professor Stringham read a paper on Orthogonal Transformations in Elliptic or in Hyperbolic Space.

The Bénard plans for the University of California were on exhibition at the Paris Exposition and were awarded a gold medal. A plaster cast of Douglas Tilden's statue, The Football Players, the trophy won by the California teams of 1898 and 1899, received a similar honor. In the Department of Forestry and Fisheries an honorable mention was also awarded to Dr. Chas. A. Kofoid, recently appointed Assistant Professor of Histology and Embryology.

Professor F. W. Putnam of Harvard University, Curator of the Department of Anthropology of the American Museum of Natural History in New York, who is visiting Arizona, New Mexico, and California to make certain investigations connected with his work, on Wednesday, October 3, addressed the Science Association on "Some Problems of American Anthropology."

The Philological Association of the Pacific Coast, which was organized at a meeting held at the Mark Hopkins Institute last December and of which President Wheeler is President, has been accepted, on terms of close affiliation, as a branch of the American Philological Association. Hereafter the general association will receive all fees from the branch society, and in return will pay all local expenses of its meetings and print in the Transactions of the American Philological Association the most notable of the papers presented at its sessions. The membership of the Philological Association of the Pacific Coast includes most of the members of the philological faculties of the University of California and Stanford University, and a number of other California, Oregon, and Washington philologists. The next meeting will be held in San Francisco December 28 and 29.

On September 1 about sixty alumni who had graduated as officers of the University Battalion, President Wheeler, Regent Denicke, twelve members of the Faculties, and Adjutant-General W. H. Seamans, N. G. C., were the guests of Colonel George W. Bauer, '97, at a dinner at the Spreckles Rotisserie in San Francisco. After the dinner the Alumni Commissioned Officers' Association of the University of California was organized, and a constitution adopted. This states the aims and purposes of the organization to be:

1st. To bring together in close social intercourse all those who during their college course have shown a taste for military science and tactics.

2d. To bring all officers commissioned from the University of California to a full realization of their duties and their privileges.

3d. To foster and promote the efficiency of the University Cadets by bringing together those who have proved themselves to be interested in the welfare of the Cadet Regiment.

The following were elected officers: Commander, Col. Geo. W. Bauer; Senior Vice-Commander, Col. H. W. Gibbons; Junior Vice-Commander, Col. J. R. Moulthrop; Adjutant, Capt. Wm. Jurgens. The roll was signed by fifty-five alumni officers, and President Wheeler, Regent Denicke, General Seamans, Capt. Winn, Capt. Cloman, and the members of the Faculties present were elected Honorary Members.

The list of intrants to the University, published September 1, showed 62 graduate admissions, as compared with 88 last year, and 654 undergraduate, as compared with 552 in 1899. The proportion of students from outside the state has risen from three per cent. in 1898 to eight per cent. in 1900. An interesting displacement of balance is found in the rapid growth of the Southern California contingent. In 1894-95 only one student in eleven came from the counties south of Tehachapi: the proportion has steadily risen until in the entering class one student in five comes from Southern California. On the other hand the proportional representation from the Bay cities of San Francisco,

Oakland, Alameda, and Berkeley shows a steady decline from sixty-seven per cent. in 1894-95 to forty-one per cent. Alameda County, which had forty and eight-tenths per cent. of all the students two years ago, shows only twenty-five per cent. among the intrants.

These figures are most significant. Despite the rapid growth of the University as a whole, the representation from Southern California grows fifty per cent. more rapidly than the University; that from outside California, two hundred per cent. more rapidly; that from the immediate neighborhood—Oakland, Berkeley, and Alameda—falls beyond forty per cent. The University is evidently rapidly becoming a university for the whole state.

The report of the Committee on Admissions at the meeting of the Graduate Council on September 28 raised the number of those admitted as graduate students to 75, and that of the Committee reporting to the Academic Council November 16 showed that at that date there had been 670 undergraduate intrants.

The Catalogue of Officers and Students (to September 17, 1900) shows that there are in the Colleges at Berkeley 180 officers of instruction and administration, 117 graduate students, and 1885 undergraduates. Of the students of the University, 17 graduate and 220 undergraduate live in San Francisco; 17 graduate and 259 undergraduate in Oakland; 2 graduate and 47 undergraduate in Alameda; and 81 graduate and 1359 undergraduate in Berkeley. That Berkeley is more and more becoming a college town is shown by the fact that, whereas six years ago but 51 per cent. of the students resided there, in 1900 it is the college residence of 71.9 per cent. The lack of dormitories is to a certain extent supplied by the sixteen fraternities for men and five for women and the ten men's house clubs and two women's.

In accordance with the custom of having distinguished scholars from other universities deliver courses of lectures

at Berkeley recently inaugurated with the lectures of Professor H. Morse Stephens of Cornell University, Professor Louis Dyer, a graduate of Harvard University who for many years has been a Fellow of and a tutor in Balliol College, Oxford, during the current month delivered at the University the following seven lectures on Mycenaean Greek Art: Introductory, The Cretan Alphabet, Dr. Schliemann's Excavations, Old Knossos and the Labyrinth of Minos, Mycenaean Gems, Lights on Homer, and Mycenaeans in Egypt. The lectures, which were illustrated by lantern-slides especially made for them, proved so popular that the largest lecture-room in the University was too small to accommodate the audiences and the Gymnasium had to be utilized for the purpose. Professor Dyer also delivered three other, unconnected lectures in Berkeley: Machiavelli and Modern Instances—an account of Machiavelli's maxims in connection with the events of the South African War, in the Gymnasium, at the Students' Hour on November 9; The Millenary Commemoration of King Alfred, an address to the members of the English Department, in the Gymnasium, on November 13; and Helen of Troy, a lecture under the auspices of the Art Association of the University of California, at Stiles Hall, on November 15. Professor Dyer also delivered two courses of University Extension lectures in San Francisco, one in the auditorium of the Academy of Sciences, on Machiavelli—1. "The Prince" and Caesar Borgia; 2. Machiavelli's Use of History; 3. Machiavelli's Idea of Morals—and the other in the auditorium of the Young Men's Christian Association, on Mycenaean Greek Art—1. Introductory; 2. Old Knossos and the Labyrinth of Minos.

